

Cross-Reference to Related Application

This application claims the benefit of copending United States patent application 09/792,663 filed February 23, 2001. Application 09/792,663 filed February 23, 2001 is specifically incorporated herein.

Background of the Invention

Field of the Invention. The present invention relates to determining the level of fluid in a container and the like.

Description of the art practices.

United States Patent 5,655,839 issued to Schmidt, et al., August 12, 1997 describes an IR temperature sensor that comprises a sealed housing containing an inert gas atmosphere and enclosing a detector for conversion of heat radiation into an electrical signal, an optical system which images the heat radiation emanating from an object onto the detector, a heat-conducting temperature equalization element which maintains the detector and the optical system at a common temperature, and a temperature sensor which measures the temperature of the temperature equalization element. The sealed housing protects the sensor from the external environment and maintains uniform temperature between the optical system and the sensor.

Further information concerning infrared temperature sensors is found in a brochure entitled Raynger® STTM that describes ST30 ProTM Standard and ST30 ProTM Enhanced noncontact thermometers. The ST30 ProTM Standard and ST30 ProTM Enhanced noncontact thermometers are available from Raytek Corporation 1201 Shaffer Road Post Office Box 1820 Santa Cruz, California 95061-1820.

United States Patent 4,362,645 that issued to Hof, et al. December 7, 1982 describes temperature-indicating compositions of matter. United States Patent 4,362,645, in particular describes stable compositions of matter which change color sharply upon a transition from a liquid state to a solid state or from a solid state to a liquid state, which change of state is at substantially a predetermined temperature corresponding to a temperature to be measured.

The constituents of the Hof, et al. compositions of matter comprise: 1. a solvent (I) consisting of a single substance or a mixture of substances and adapted to change from a solid state at substantially a predetermined temperature to a liquid state and 2.

1 an indicator system (II) consisting of one or more substances different from (I),
2 characterized in that (a) (II) is soluble in (I) when the latter is in the liquid phase, and (b)
3 (II) changes color visible to the naked eye when (I) passes from the solid to the liquid
4 phase or from the liquid to the solid phase. Thermometers containing said stable
5 compositions of matter are also disclosed.

6 United States Patent 4,339,207 also to Hof, et al. which issued July 13, 1982
7 describes a temperature indicating device is disclosed comprising: (a) a flat or gradually
8 curved heat-conducting carrier having one or more cavities, each substantially filled with
9 a composition of matter; or in the alternative, with (1) a composition of matter which
10 changes from opaque to transparent upon a corresponding change from solid to liquid
11 on top of an (2) indicator means located at the bottom of the cavity; said composition of
12 matter, whether novel or not, being substantially without impurities and containing a
13 substantially spherical void space between the bottom of the cavity; and (b) a
14 transparent cover sheet means in sealing engagement with the heat conducting carrier
15 means overlying and above the cavity, which spherical void space acts to magnify the
16 color change if the novel compositions of matter are present or the presence of an
17 indicator means upon melting of the compositions of matter in the cavity.

18 The compositions of matter of Hof et al., are further described as changing color
19 sharply upon a transition from a liquid state to a solid state or from a solid state to a
20 liquid state, which change of state is at substantially a predetermined temperature
21 corresponding to a temperature to be measured.

22 United States Patent 4,232,552 issued to Hof, et al. November 11, 1980
23 discloses temperature-indicating compositions of matter. The Hof, et al. compositions
24 Novel and stable compositions of matter are disclosed which change color sharply upon
25 a transition from a liquid state to a solid state or from a solid state to a liquid state, which
26 change of state is at substantially a predetermined temperature corresponding to a
27 temperature to be measured. The constituents of the novel compositions of matter
28 comprise: 1. a solvent (I) consisting of a single substance or a mixture of substances
29 and adapted to change from a solid state at substantially a predetermined temperature
30 to a liquid state and 2. an indicator system (II) consisting of one or more substances
31 different from (I), characterized in that (a) (II) is soluble in (I) when the latter is in the

1 liquid phase, and (b) (II) changes color visible to the naked eye when (I) passes from
2 the solid to the liquid phase or from the liquid to the solid phase. Thermometers
3 containing stable compositions of matter are also disclosed in United States Patent
4 4,232,552.

5 Seiden, et al., in United States Patent 5,426,593 issued June 20, 1995 is directed
6 to a device which measures the oxygen component of a beverage gas using a specific
7 oxygen probe, ultrasonic degassing, a special valving technique, and microprocessor
8 based software. The measurement is made in the gaseous state in a two-chamber
9 system.

10 The device of Seiden, et al., is controlled by an electronic console that is built
11 around a microprocessor which sequences and times the valves, receives the data from
12 the oxygen probe and its accompanying temperature compensation circuit, and displays
13 the data. An alternative method is to use several chambers and one pass. Additional
14 chambers may be used to increase the speed of the test, control interferences, or aid in
15 identifying gases other than the oxygen component. The device may also have an
16 interface piercing head manifold that allows carbon dioxide and oxygen to be tested in
17 the same container and in one preparation. The invention also relates to specific gas
18 measurements with non-specific type measurements and the general techniques can be
19 applied to environmental problems that involve oxygen demand and respiration of
20 bacteria.

21 United States Patent 6,119,464 issued to Nakayama, et al. on September 19,
22 2000 describes beverage servers and controlling methods for beverage servers. More
23 particularly, Nakayama, et al. discloses a beverage server comprising a tank containing
24 water serving as a coolant and a coiled beverage duct through which beer or other
25 beverage flows and cooling means fitted to a portion of the wall of the tank so as to
26 rapidly cool and serve beer or other beverage discharged from the storage container.
27 The inner wall of the tank near the portion where the cooling means is fitted is made of
28 a material having a high thermal conductivity, whereas the inner wall of the tank near
29 the beverage duct is made of a material having a low thermal conductivity. A sensor is
30 provided near the beverage duct to obtain information for controlling the cooling means.
31 This simple beverage server assures stable serving of beverage at a suitable

1 temperature. Another sensor is provided near a portion of the tank wall where the
2 cooling means and a controller to controls the action of the cooling means based on the
3 information from the sensors are also provided. The cooling means works at full
4 capacity when one or both of the sensors have detected the melting of the coolant. This
5 eliminates the risk of trouble due to cooling capacity deficiency even after a long
6 interruption of cooling.

7 Furuhashi, et al., in United States Patent 5,165,569 issued November 24, 1992
8 recites a keg body for retaining draft beer substantially has adiabatic structure, in which
9 draft beer filled in the keg body is kept cool. A part of the keg body is provided with a
10 face which is not heat-insulated and this face is utilized as a cooling face. In case of
11 necessity, beer is cooled from the outside through the cooling face to keep cool draft
12 beer inside the keg body.

13 The reader is also directed to Hammerhead Products Accu-Level propane tank
14 gauge. Hammerhead Products is located at 1720-22 Street Santa Monica, California
15 90404.

16 To the extent that the foregoing patents are relevant to the present invention they
17 are herein incorporated by reference. Temperatures herein are given in degrees
18 Fahrenheit and pressures are in gauge Kpa. Ratios and ranges may be combined.
19

Summary of the Invention

The present invention describes a method for determining the level of fluid in a container comprising:

obtaining a container having an outlet for a first fluid and an inlet for a second fluid;

said container having a first fluid region therein;

a first fluid being present at an original level in said first fluid region of said container;

said container, for when in use, having said first fluid at least partially removed from said container thereby forming a second fluid region;

placing on at least one exterior surface of said container at least one temperature-measuring device;

at least one said temperature-measuring device being located in a region of said container where said second fluid region is formed by removal of said first fluid;

initially observing a first temperature in said first fluid region of said container when said first fluid is present in said first fluid region of said container;

subsequently observing a second temperature in said second fluid region of said container after a portion of said first fluid has been removed;

correlating the difference between said first temperature and said second temperature to the level of said first fluid in said container.

Yet another aspect of the invention is a temperature-measuring device mounted on a magnetic strip said temperature measuring device having a width, a height, and a thickness, provided further that the dimensionless ratio of said width to said height is about 0.5 to about 10 to about 1 to about 5.

Another aspect of the invention is a temperature-measuring device mounted on an adhesive strip said temperature measuring device having a width, a height, and a thickness, provided further that the dimensionless ratio of said width to said height is from about 0.5 to about 10 to about 1 to about 5.

A further embodiment of present invention is a fluid dispensing assembly comprising:

a sealed container, for when in use, containing a liquid under pressure;

1 said sealed container having an exterior surface;
2 said exterior surface of said sealed container having a heightwise dimension and
3 a widthwise dimension;
4 at least one temperature-measuring device positioned heightwise dimension on
5 said exterior surface, provided further that said temperature-measuring device
6 measures temperatures in the range of about 34 ° F to about 94 ° F.

7 Yet another aspect of the invention is a flexible band temperature-measuring
8 device capable of determining a 2° F temperature change in the range of about 34 °
9 F to about 94 ° F.

10 Another aspect of the invention is device comprising a series of at least two
11 substantially parallel strips having temperature-measuring capability.

Brief Description of the Drawings

The foregoing and other features of the present invention will become apparent to one skilled in the art to which the present invention relates upon consideration of the following description of the invention with reference to the accompanying drawings, wherein:

FIGURE 1 is a partial cross-sectional perspective view showing a first embodiment of a beer keg of the invention;

FIGURE 2 is a longitudinally cross-sectional view showing a beer keg having draft beer in the beer keg;

FIGURE 3 is a view showing a beer keg;

Figure 4 is a thermometric fastening device according to the invention;

Figure 5 is a view of another embodiment of the invention;

Figure 6 is a longitudinally cross-sectional view showing a beer keg having draft beer in the beer keg; and,

Figure 7 is a schematic OF a thermometric measuring device.

Detailed Description of the Invention

In FIGURE 1, a beer keg 1 according to a first embodiment of the invention is shown. The beer keg 1 is generally cylindrical.

As shown in FIGURE 2, the beer keg 1 is a container made of thin stainless steel plate, and having a mouthpiece 2 and a bottom. The beer keg 1 is prepared by welding an inner cylinder upper plate 3, the outer cylinder shell 6, and an outer cylinder lower plate 9.

The outer cylinder shell 6 is in a cylindrical form and is integrally sealed, at its upper and lower edges with the inner cylinder plate 3 and the outer cylinder plate 9, respectively, by TIG welding. In this embodiment, the mouth piece 2 is mounted on the center of the inner cylinder plate 3. A down tube 13 shown in FIGURE 3 is inserted into the beer keg 1 through the mouth piece 2.

The down tube 13 is a tube for providing draft beer into the inside of the beer keg 1 and also ejecting draft beer from the beer keg 1. The down tube 13 has a carbon dioxide-valve (not shown) and a beer valve (not shown) and is screwed in the mouthpiece to be fixed.

The keg outer cylinder 6 is formed of an outer cylinder shell 8 and an outer cylinder lower plate 9. The outer cylinder shell 8 has an upper grip 7 at its upper opening edge and a keg leg 10 at its lower opening edge, respectively. Both upper and lower edges are bent inwardly. The diameter of the upper edge is slightly smaller than that of the lower edge, but the upper and lower portions of the outer cylinder shell 8 may be reversible upside down.

At the proper standing posture of the outer-cylinder shell 8, the upper edge acts as the upper grip 7 and the lower edge operates as the keg leg 10. At the inverted posture thereof, the upper edge acts as the keg leg 10 and the lower edge acts as the upper grip 7.

As shown in FIGURE 1, a plurality of thermometric measuring devices 12 are provided on the outer cylinder shell 8. The thermometric measuring devices 12 are designated as 12 A, 12 B, 12 C, and 12 D. The thermometric measuring devices 12 are so designated by the appended letter to show the location on the keg outer cylinder 6.

1 Several eutectic materials are disclosed in United States Patent 4,362,645 that
2 issued to Hof, et al. December 7, 1982 as well as the remaining cited Hof, et al. patents.
3 Similar eutectic may be formulated from foregoing disclosures to provide a suitable
4 temperature range for determining the temperature within a container such as a beer
5 barrel.

6 The thermometric measuring devices 12 are first located along the height of the
7 keg outer cylinder 6 and generally correspond to a level of 10 percent of maximum fluid
8 content of the beer keg 1, 25 percent of maximum fluid content of the beer keg 1, and
9 75 percent of maximum fluid content of the beer keg 1. Alternatively, thermometric
10 measuring devices 12 are conveniently located at a point from 5 % to 35% of the
11 maximum original fluid level in said first fluid region of said container.

12 The thermometric measuring devices 12 are also located circumferentially
13 around the keg outer cylinder 6. Conveniently, the thermometric measuring devices 12
14 located around the circumference of the keg outer cylinder 6 are two, three, four, five,
15 six, seven, or eight in number.

16 The thermometric measuring devices 12 located around the circumference of the
17 keg outer cylinder 6 are to aid in the determination of fluid level. As the beer kegs are
18 quite heavy and when tapped with associated piping the movement of beer kegs is
19 difficult. Also the movement of the beer kegs into a cooler of confined dimensions
20 makes it difficult to move the kegs within a cooler. Accordingly, a plurality of
21 thermometric measuring devices 12 makes it easier to see at least one of the
22 thermometric measuring devices 12.

23 When for example, there are two of the thermometric measuring devices 12
24 circumferentially located on the keg outer cylinder 6 either of the two the thermometric
25 measuring devices 12 may be read. If there are three of the thermometric measuring
26 devices 12 circumferentially located on the keg outer cylinder 6 and each is located
27 approximately 120 degrees apart it will be easier to see at least one of the thermometric
28 measuring devices 12.

29 The thermometric measuring devices 12 are conveniently placed in as close a
30 contact as is possible with keg outer cylinder 6. The thermometric measuring devices
31 12 may be adhesive backed to permit relatively intimate contact with the keg outer

1 cylinder 6. Alternatively, the thermometric measuring devices 12 may be affixed to the
2 keg outer cylinder 6 by means of a transparent pressure sensitive adhesive tape (not
3 shown). The transparent pressure sensitive adhesive tape permits viewing of the
4 thermometric measuring devices 12 to determine the temperature and accordingly the
5 volume level of the beer keg 1.

6 The outer cylinder lower plate 9 is provided with a nozzle 11 having a valve.
7 After the valve is opened and the nozzle 11 is connected to a vacuum pump (not
8 shown) air or liquid in the beer keg 1 is removed. In this manner the beer keg 1 may be
9 cleaned. Then, the valve is then closed to permit filling of the beer keg 1.

10 In a brewery, there is a line where a beer keg 1 incorporated with the down tube
11 13 is automatically washed and draft beer is automatically filled in the beer keg 1.
12 Similarly, the beer keg 1 of the present invention is automatically washed and filled with
13 draft beer by using the above-mentioned line. The beer keg 1 filled with the draft beer is
14 stored in a refrigerator for shipping to forcibly cool beer in the beer keg 1 through the
15 face Cz. In shipping, as shown in FIGURE 3, the upper face of the inner cylinder upper
16 plate 3 of the beer keg 1 is covered with an adiabatic mat 14 to keep low temperature.
17 The beer keg 1 is kept in a proper standing posture, so that temperature of draft beer
18 filled in the beer keg 1 does not substantially rise due to the fact that draft beer is heat-
19 insulated by the vacuum layer between the beer keg 1 and the outer cylinder shell 8.
20 After the beer keg 1 of the present invention is supplied to and stored in a tavern, beer
21 is kept cool in a refrigerator in an inverted posture or horizontal posture. Draft beer is
22 cooled through the face Cz of the inner cylinder upper plate 3, so that the draft beer can
23 be effectively forcibly cooled.

24 In the beer keg 1 described in the present invention, the upper end hole of the
25 outer-cylinder shell 8 is reduced in diameter to be smaller than the lower end hole, but
26 either one of the upper and lower edges of the outer cylinder shell 8 becomes a grip or
27 keg leg, so that the beer keg 1 can be placed without distinguishing upper and lower
28 portions. On sale of draft beer at a tavern, beer is supplied in a conventional manner to
29 a pitcher and so on through the down tube 13 while carbon dioxide is injected with
30 pressure, wherein the beer keg 1 is vertically positioned to locate the mouth piece

upwardly. To keep the draft beer cool during the sale is made by inserting a cooling agent a between the adiabatic mat 14 and the inner cylinder upper plate 3.

As best seen in Figure 4, is a temperature-measuring device 40 mounted on a flexible band 44. The temperature-measuring device 40 is conveniently secured to a flexible band 44 such that the thermally sensitive portion of the temperature-measuring device 40 may be exposed to the outer side of a beer barrel. The temperature-measuring device 40 is conveniently insulated so that the ambient temperature such as in a region of low humidity as a refrigerator or refrigerator compartment will not interfere with the temperature-measurement and thus determination of level of fluid in the beer barrel.

The flexible band 44 may be an endless band such as formed from an elastomeric material. In a preferred embodiment, the flexible band 44 is a non-endless belt that is secured with a hook 52 and eye 54 fastener (Velcro). The temperature-measuring devices described herein are capable of determining a 2° F temperature change in the range of about 34 ° F to about 94 ° F, preferably in the range of about 34 ° F to about 80 ° F.

As best seen in Figure 5 is a conventional mercury thermometer 70. The mercury thermometer 70 is placed on a beer barrel. A small amount of an insulating material 72 is placed on the ball of the thermometer to ensure that is the temperature of the beer barrel and not the ambient temperature in the refrigerator that is observed.

In use, as best seen in Figure 2, is the level of beer 80 in a beer keg 1. It is observed that the beer 80 within the beer keg 1 has excellent heat flow characteristics when compared to the gas in the headspace out of the liquid level of the beer. As the beer 80 is withdrawn from the beer keg 1 through the down tube 13, increased headspace occurs. The gas in the headspace will typically be warmer than the liquid in the beer keg 1. As such a temperature-measurement in the region of that headspace will result in a higher temperature than that in the liquid.

As best seen in Figure 3, as the beer 80 is drawn from the level of 12 D to 12 C the heat flow characteristics will cause the thermometric measuring device 12 D to increase in temperature and to change color. The thermometric measuring device 12 C will maintain its temperature and not change color until the liquid level drops to the

1 region below thermometric measuring device 12 C.

2 As the tavern owner will desire to know only the level of various kegs of beer it is
3 possible to make such determination by observing where the colder temperature region
4 of the beer keg is located. Thus, when the temperature of the beer keg 1 indicates that
5 the colder temperature is only at the lower 10 percent of the beer keg 1 it is easily
6 determined that the beer keg 1 should be changed prior to a busy evening. Of course,
7 the temperature indicator on the beer keg 1 is also more than adequate to determine
8 which are kegs are of sufficiently low temperature from which to serve the beer. The
9 present invention also provides an opportunity for loss prevention or inventory control by
10 tavern keeper.

11 In a situation where the mercury thermometer is utilized, the thermometer may
12 be moved around on the beer keg 1. The present invention may also utilize the eutectic
13 strips to determine during the course of the evening as to how far the beer has been
14 depleted. The eutectic strips utilized herein may be of the liquid crystal variety. The
15 tanks and cans with which the present invention is primarily concerned contain both a
16 gas and a liquid phase. Therefore, beer, and carbonated soft drinks provide an
17 excellent venue for the volume determination. Other products which may be employed
18 include any common aerosol product such as pressurized whipped cream or a product
19 such as a pressurized insecticide. However, it is possible to obtain readings on
20 products in which a gas phase is formed as the product is utilized. Thus various
21 aspects of the present invention may be utilized to determine the level in a container
22 having therein oxygen, Freon (chlorofluorocarbons), acetylene, butane, propane,
23 nitrogen, and the like.

24 As best seen in Figure 6, is a second version of a beer keg 1 as shown in Figure
25 1. In Figure 6 there is an outlet tube 113 and a down tube 115. The outlet tube 113 is
26 employed first to fill a liquid such as beer into the beer keg 1. Typically, a liquid such as
27 beer will have carbon dioxide dissolved therein. The outlet tube 113 is then sealed to
28 an airtight state. A single thermometric measuring device 120 in the form of an
29 elongated thin strip is mounted on the side of the beer keg 1. The single thermometric
30 measuring device 120 extends beyond the two ribs 126 and 128 on the outer cylinder
31 shell 8 of the beer keg 1.

1 To prevent the beer from oxidizing, the down tube 115 has any remaining air
2 (oxygen) drawn off by a vacuum from the beer keg 1. Thereafter, carbon dioxide may
3 be added through the down tube 115 so that no other gas comes in contact with the
4 surface of the beer. The down tube 115 is then sealed to an airtight state. In this
5 manner the beer in the beer keg 1 is kept fresh and also has the correct degree of
6 carbonation.

7 The beer keg 1 when tapped at a public house will have both the outlet tube 113
8 and the down tube 115 opened. The outlet tube 113 will then be connected to the
9 appropriate tapped beer supply line (not shown). The down tube 115 will then be
10 connected to a regulated carbon dioxide gas supply line (not shown). As of the beer is
11 drawn off to the outlet tube 113 carbon dioxide is introduced through the down tube 115
12 to maintain the atmosphere within the beer barrel relatively free of oxygen and to
13 provide pressure to force the beer through the outlet tube 113.

14 As the level of the beer in the beer keg 1 is reduced from a first beer level to beer
15 level 80 the thermometric measuring device 120 rapidly detects the changing level of
16 the beer because that portion of the temperature sensor on the beer barrel in the region
17 of the gas above the beer level will be of a different color than the color where the liquid
18 is present. The foregoing is believed to occur because the gas above the liquid surface
19 is less able to draw in heat from the ambient region than is the liquid below the liquid
20 surface. To aid in the temperature determination one may wipe a damp cloth along the
21 temperature sensor to aid in the heat transfer effect. The damp cloth is at room
22 temperature and may be conveniently utilized in a temperature range of 45 ° F to 105 °
23 F. The method for determining the level of said first fluid in said container according to
24 claim 1 additionally comprising the step of wiping the temperature-measuring device
25 with a water moistened cloth wherein the temperature of the water-moistened cloth is
26 less 90 ° F.

27 A variation on the present invention is to utilize a pony keg or a quarter barrel of
28 beer (effectively differing only in size from the keg 1). In this situation, the pony keg is
29 placed in a tub of ice to maintain the beer in a cold state. In this case the down tube
30 115 typically utilizes air pressure that is manually pumped into the pony keg. As the
31 pony keg will typically be emptied the relatively short period of time the presence of

1 atmospheric oxygen does not deteriorate the flavor of the beer. The temperature strip
2 will accurately determine changes in the volume of the pony keg.

3 The thermometric measuring device 120 in the form of the strip is usually
4 adhesive backed or magnetically backed. The adhesive backing or the magnetically
5 backing permit easy attachment to the beer keg 1.

6 The products that are placed in sealed containers such as the beer keg 1,
7 according to the present invention, are preferably intended for use at less than 100
8 pounds per square inch to at 70 degrees Fahrenheit. Preferably, the products in the
9 sealed containers according to the present invention are pressurized between 5 and 90
10 pounds per square inch, or preferably between 10 and 80 pounds per square inch at 70
11 degrees Fahrenheit.

12 The thermometric measuring device 120 intended for a beer keg or relatively
13 similarly sized pressurized container are up to 14 inches in length with a width of three-
14 quarters of an inch. Conveniently, the temperature strips for cans are about 6 inches
15 long with a width of three-quarters of an inch. The dimensionless ratio of the width to
16 the height is about 0.5 to about 10 to about 1 to about 5, and preferably the dimension-
17 less ratio of the width to the height is about 0.7 to about 10 to about 1 to about 4.

18 The thermometric measuring device 120 is sufficiently sensitive to temperature
19 changes, which are indicative of volume, such that an ordinary can such as whipped
20 cream can (not shown) may have the remaining product determined by removing the
21 whipped cream can from the refrigerator and placing it on a table for a few minutes.
22 The color indicator of the thermometric measuring device 120 will then change with a
23 relatively sharp line forming between the gas and liquid phases in the whipped cream
24 can. Any can for which the temperature of the volume is desired should be maintained
25 in an upright position and unnecessary shaking of the can avoided. Alternatively, a food
26 product containerized in an aerosol can may be placed in the freezer compartment of a
27 refrigerator for a few minutes and then removed. The temperature change of the single
28 thermometric measuring device 120 in the form of an elongated thin strip is observed
29 and the volume determined. A further method of determining the remaining product
30 volume is to utilize the heat of the hand to slightly warm the can and then observe the
31 color change in the single thermometric measuring device 120 in the form of an

1 elongated thin strip.

2 Alternatively, as best seen in Figure 7 is a thermometric measuring device 140.
3 The thermometric measuring device 140 is mounted on a magnetic strip 144. As
4 previously discussed the thermometric measuring device 140 operates by sensing a
5 color change that indicates the volume of a container. The thermometric measuring
6 device 140 is formed from a plurality of separate sensors 146 the first of which is
7 labeled 148. The first sensor 148 operates at a separate temperature range. Thus, for
8 example, the first sensor strip 148 operates to indicate a temperature change, and
9 hence volume, at from 36 ° F to 46 ° F, whereas the second sensor strip 148 operates
10 from 46 ° F to 56 ° F, and so forth. The plurality of separate sensors 146 permits the
11 operation of the thermometric measuring device 140 to function at differing ambient
12 temperatures without the need for artificial aids such as pouring hot water on a propane
13 tank. Additional sensors are shown as A & B and function over differing temperature
14 ranges.

15 As one further embodiment, is possible to utilize an infrared thermometric device
16 to make the determination of level of liquid in the beer keg 1. However, it is preferred
17 that the thermometric temperature-measuring device be permanently affixed to the
18 container so that it is readily available for the determination of volume and temperature.
19